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Art. XIII.—*Flowering Periods of Victorian Plants.*

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In the following pages an attempt has been made to give, in the form of graphs, a phenological record for all native Victorian genera of plants, with the exception of the genus *Eucalyptus.* This genus has been omitted on account of the irregularity of its flowering—some species flower biennially, others triennially, so that it would be impossible to give a satisfactory record in one graph for the genus as a whole. The graphs are intended to cover the flowering periods throughout the whole State, although these will necessarily vary slightly in different parts according to habitat, rainfall, etc. Just as they vary in different parts of the State in any one season, they also vary in the same part according to the season. In most cases, however, the variations in the time of flowering are not as great as one might expect, and do not amount to more than a few weeks even with great variation in rainfall, temperature or elevation.

The months during which each species was in flower were recorded from observations in the field, and from Herbarium records. Then, by combining the flowering periods of all species of a genus, a single flowering period for that genus was obtained. In this way, a more generalised summary is made possible with less interference due to the irregular behaviour of individual species. From these records also, that portion of the flowering period during which the majority of species are in flower, can be observed. This portion has been represented in the graphs by a very thick line (▬▬). A thinner line (———) represents the period during which an average number of species flower, and a very fine line (———) shows when a single species or an occasional plant of a species is in flower. In some cases, as in Acacia, extra degrees of thickness have been employed to denote more pronounced differences in the number of species in flower. Several genera, such as *Morgania* and *Rochelia,* can be found in flower all the year round, according to the climatic conditions without a climax at any particular time. This has been shown in the graphs by a short, thick line in each month thus ▬▬ ▬▬. In some genera, such as *Drakaea*, two distinct flowering periods are illustrated. This is necessary when the species of the genus do not have a common flowering period, but flower at different times of the year. In these cases, numbers are given on the graphs with the genus corresponding to the numbers opposite the species in the Flora of Victoria (1).

Tables have been constructed from these graphs to test a hypothesis put forward by Illichevsky on the Data of Systematics, and the Order of Flowering (2). On this hypothesis the order of flowering of plants during a summer coincides with the order of their phylogenetic evolution—that is, the most highly developed plants—those with inferior ovaries, sympetalous flowers, etc.—being more complex, require for their maturation and flowering a longer time and a greater quantity of warmth than simpler plants. Further, it implies that plants should flower in the order in which they prevailed during geological periods. The following tables, set out on the lines of those of Illichevsky, show that the Victorian Flora does not agree with this hypothesis. Not only the summer months but every month in the year is taken into account.

An examination of Table I, which deals with the dicotyledons as a whole, show a gradual rise from June to November in the number of genera in flower, then a gradual decline to the following June.

TABLE I.—ALL DICOTYLEDONS.

No. of genera		June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
404	No. in flower	28	61	118	226	305	328	313	250	160	105	61	29
	%	6·9	15·1	29·2	55·9	75·5	81·2	77·5	61·9	39·6	26·0	15·1	7·2

Exactly the same rise to November and fall to June is shown in Tables II and III. These tables deal only with the more highly developed plants—those with inferior ovaries (Table II) and those with sympetalous flowers (Table III), so that, if Illichevsky's theory held, there should be a later maximum shown in the two latter tables than in Table I. There should be a steady increase to February, which is our hottest month, instead of the rise to November, followed by a gradual decline over the hotter months of December, January and February, as is actually shown.

TABLE II.—DICOTYLEDONS WITH INFERIOR OVARIES.

No. of genera		June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
112	No. in flower	3	8	23	56	81	91	89	76	35	34	22	11
	%	2·7	7·1	20·5	50	72·3	81·3	79·5	67·9	29·5	30·4	19·6	9·8

TABLE III.—SYMPETALAE (DICOTYLEDONS).

No. of genera		June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
148	No. in flower	7	14	34	72	117	128	118	95	53	38	22	11
	%	4·7	9·5	23·0	48·6	79·0	86·5	79·7	64·8	35·8	25·7	14·9	7·

Again, if Illichevsky's hypothesis held any truth, it should be borne out by the family Compositae, which is generally regarded as highly specialised, and hence fairly recently evolved. One would expect to find a very late maximum, but here, too, only the same rise to November and fall to June, as is in (Tables I, II, III) can be seen.

TABLE IV.—COMPOSITAE (DICOTYLEDONS).

No. of genera		June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
51	No. in flower	2	4	12	26	35	38	33	28	15	14	10	7
	%	3·95	7·8	23·5	50·9	68·3	74·5	64·7	54·9	29·8	27·45	19·6	13·7

The tables dealing with Monocotyledons do not show quite the same regular rise and fall. In Table V, which includes all the monocotyledonous genera, the maximum month is December, with a gradual decrease to June. Thus the Monocotyledons as a whole seem to flower later than the Dicotyledons.

TABLE V.—ALL MONOCOTYLEDONS.

No. of genera		June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
163	No. in flower	12	20	37	72	102	123	138	101	77	51	33	15
	%	7·4	12·3	22·7	44·2	62·6	75·5	84·7	62·0	47·2	31·3	20·3	9·2

Some of the more highly developed Monocotyledons, taking for example those with inferior ovaries, show the same maximum in December (Table VI).

TABLE VI.—MONOCOTYLEDONS WITH INFERIOR OVARIES.

No. of genera		June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
35	No. in flower	6	9	13	17	20	21	23	18	10	8	10	8
	%	17·1	25·7	37·1	48·6	57·1	60·0	65·7	51·4	28·6	22·9	28·6	22.9

In Table VI there seems to be a slight rise again in April before the final minimum in June. This slight rise in April is probably due to the Autumn flowering orchids, for the table representing Orchidaceae shows the same variation. In Orchidaceae (Table VII) the maximum is spread over September, October and November.

TABLE VII.—ORCHIDACEAE.

No. of genera		June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
25	No. in flower	5	8	11	14	14	14	13	6	3	2	6	4
	%	20	32	44	56	56	56	52	24	12	8	24	16

Orchidaceae is generally regarded as the most highly developed monocotyledonous family, and therefore, if this is so, it is a direct contradiction of Illichevsky's hypothesis, for all the monocotyledons together—including primitive as well as highly developed genera—show a later flowering maximum than do these specialised orchids.

The family Gramineae (Table VIII) shows the same rise and fall as all the Monocotyledons (Table V).

TABLE VIII.—GRAMINEAE.

No. of genera		June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
54	No. in flower	3	3	9	18	31	43	48	45	36	21	13	—
	%	5·5	5·5	16·6	33·3	57·4	79·6	88·8	83·3	66·6	38·9	24·0	—

Some slight agreement with the hypothesis is shown by the family Liliaceae. The maximum flowering is in October, while the minimum is spread over May, June and July. Here it is shown that a primitive family like Liliaceae has an earlier maximum than the monocotyledons as a whole.

TABLE IX.—LILIACEAE.

No. of genera		June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
25	No. in flower	—	—	5	15	22	21	19	14	7	3	1	—
	%	—	—	20	60	88	84	76	56	28	12	4	—

Thus, of all the tables constructed, No. IX alone shows any agreement with Illichevsky's theory. For the Victorian flora as a whole, the maximum flowering month is November, while the minimum is June, and between these two months there seems to be a fairly steady rise and fall. Moreover, if the number of species in flower in each month is calculated instead of the number of genera, the position of the maximum remains the same. It seems, therefore, on the evidence presented by these tables that factors other than that of temperature, which Illichevsky regards as the main one, affect the period of flowering. One of the main factors to be considered is that of rainfall. With early rains, plants will doubtless flower earlier. In Central Australia, immediately after the rains, plants spring up, flower and die in a few weeks. These plants, of course, are annuals which seem to adjust themselves more readily to variations in the conditions. In this instance, the flowering period depends entirely on the rainfall. Even in Victoria, in spite of its moister climate, the supply of water is more commonly a limiting factor to plant development than is temperature. Only very few areas in Victoria have a rainfall approaching 40 inches; the average is not more than 20 inches, and in the northern areas the lowest rainfall coincides with the highest annual temperatures so that the general conditions are strongly xerophytic. In addition, the hot north winds which come from the dry interior, in the course of ages, may have had the effect of shortening the summer flowering period in many of the more delicate plants. Plants which are capable of perennating over a dry period—those with bulbs, for instance—will often lie dormant during more or less unfavourable conditions until the rains come or moisture is otherwise supplied.

The habitat is another factor affecting the flowering period which must be taken into account. Plants growing in a shaded valley, for instance, will often flower at a later date than those on the sides of a hill, or on a level plain fully exposed to the sunlight. Another factor which may have some slight effect on the period of flowering is the presence of insects. Flowers pollinated by insects must flourish during the life cycle of the insects on which they are dependent, if they can only reproduce by seeds, and if they are incapable of self-pollination or unable to form cleistogamous flowers. Several other factors also should probably be taken into account—such as the chemical and physical composition of the soil and internal factors, so that no single factor can be the sole determinant of the time of flowering and its duration.

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References.

1. A. J. Ewart. Flora of Victoria (In press, 1930).

2. S. Illichevsky. Data of Systematics and the Order of Flowering. *Proc. International Congress of Plant Sciences*, ii, 1926.

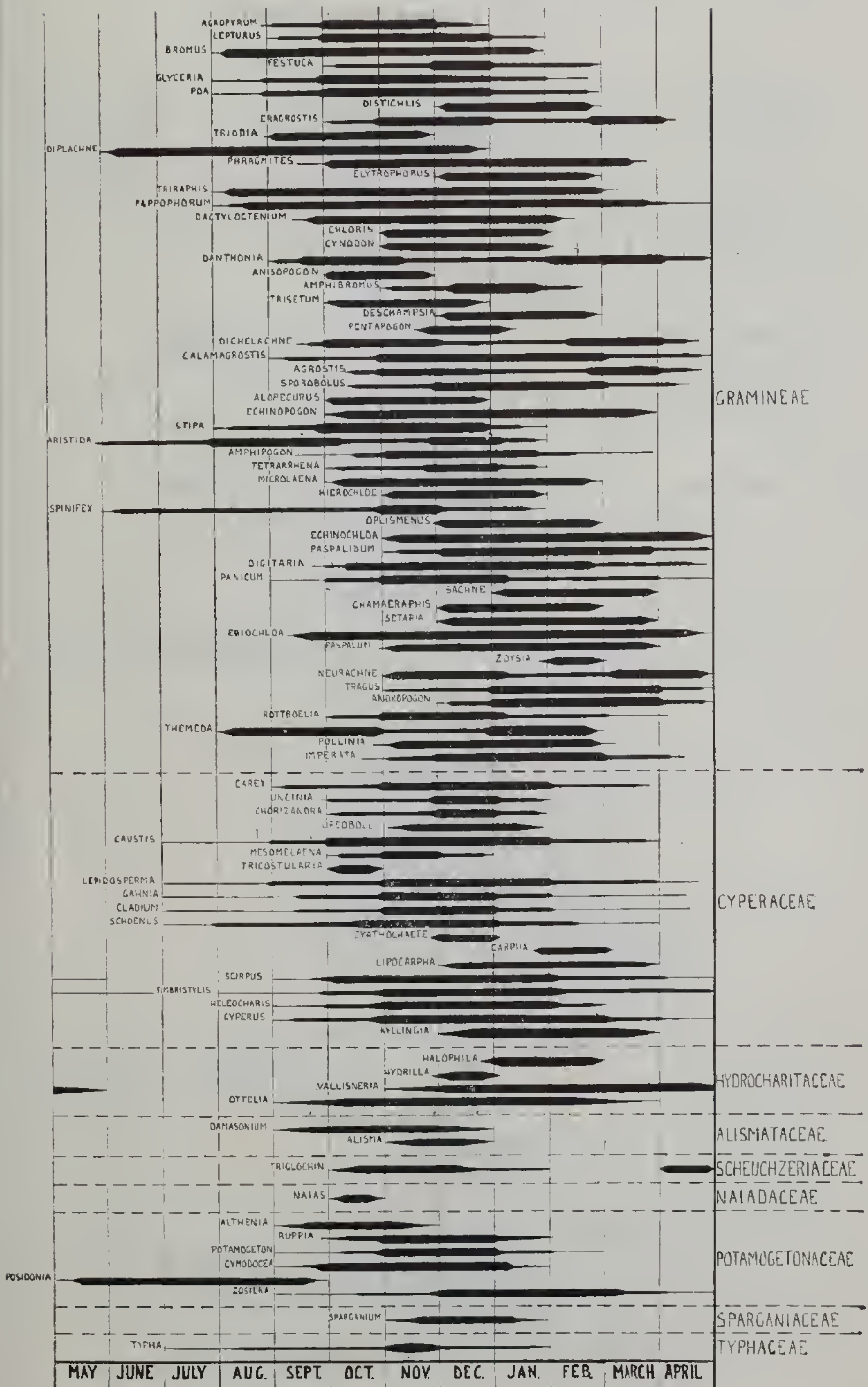
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Fig. 1.

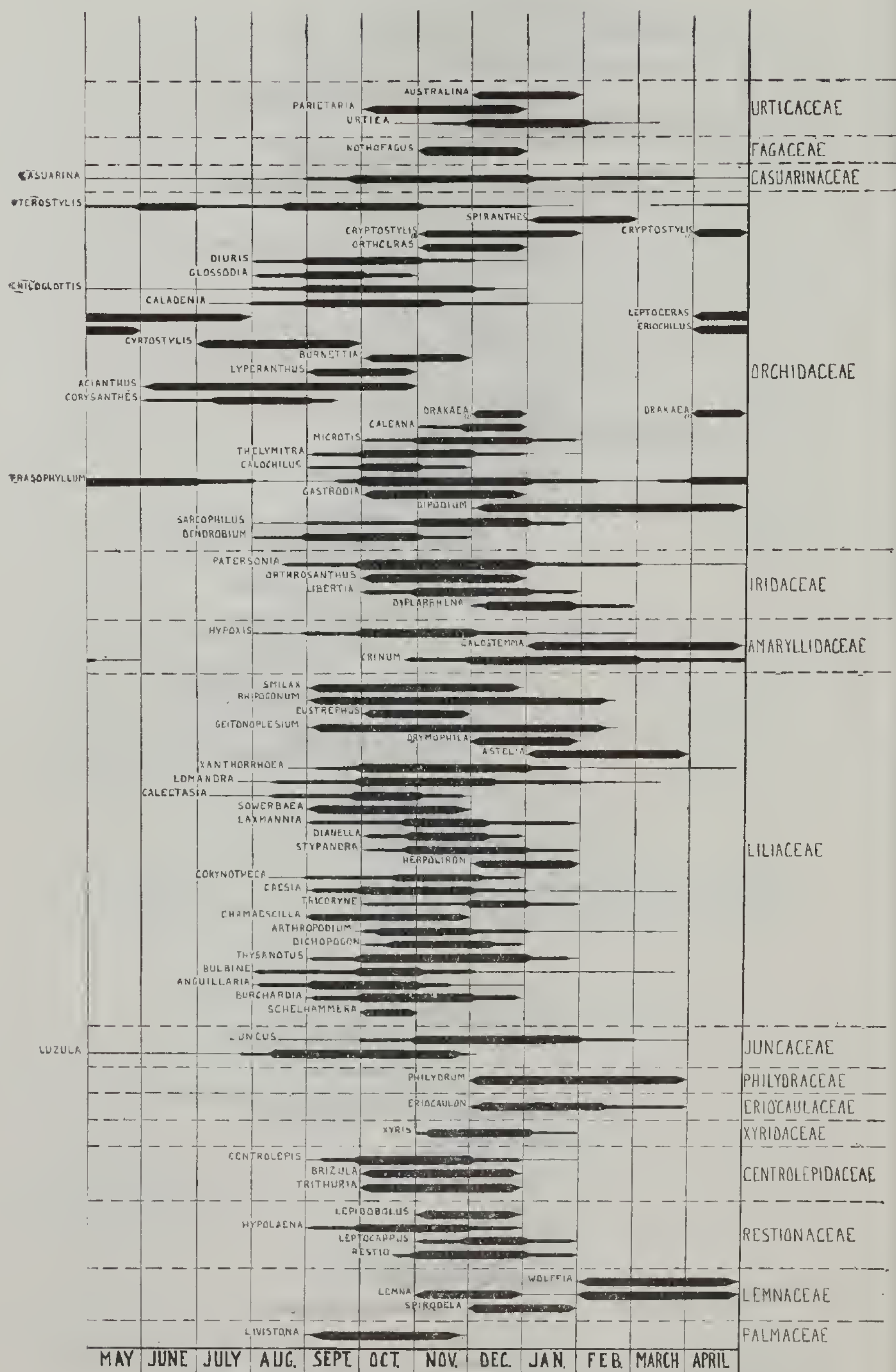
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Fig. 2.

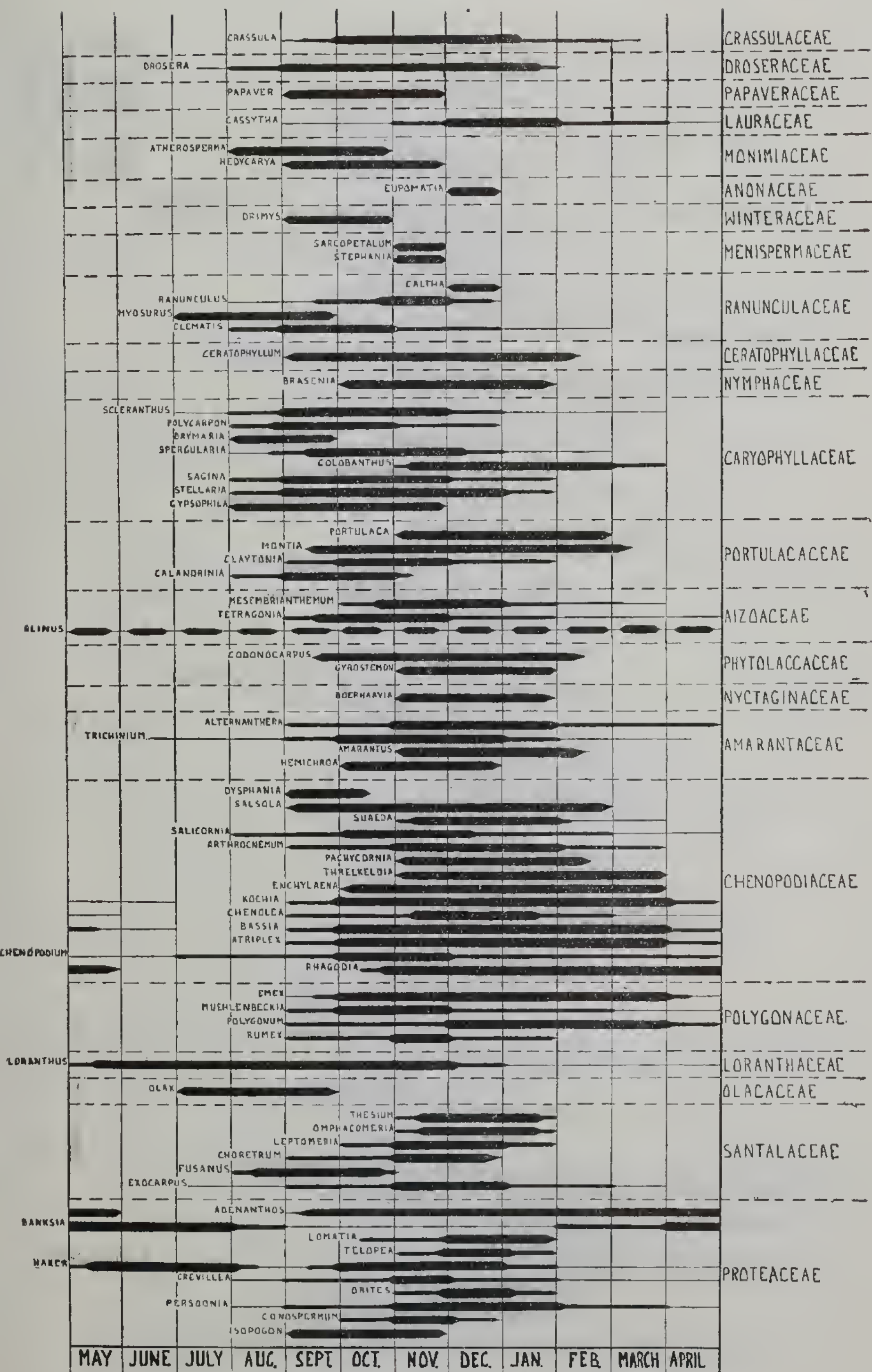
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Fig. 3.

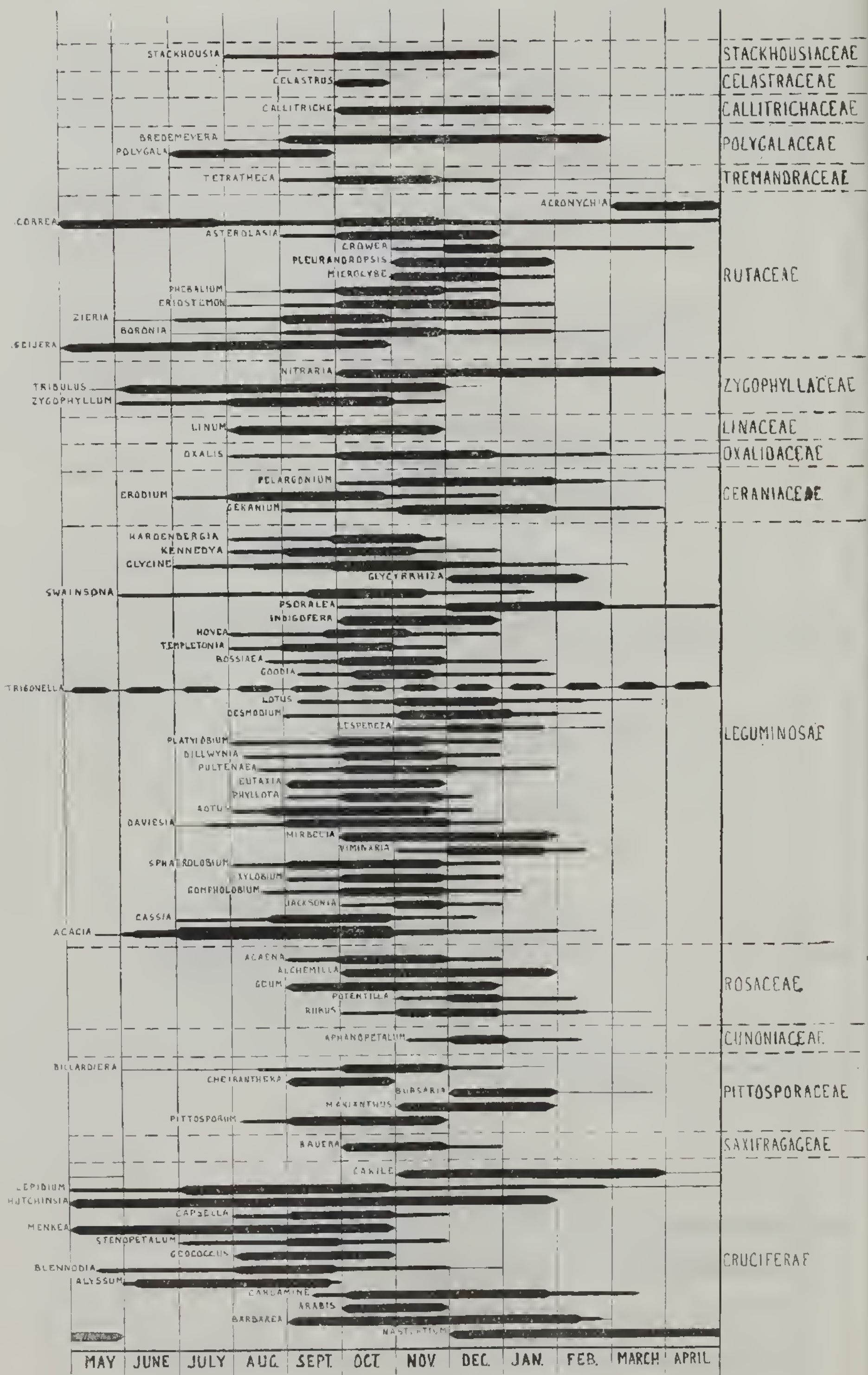
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Fig. 4.

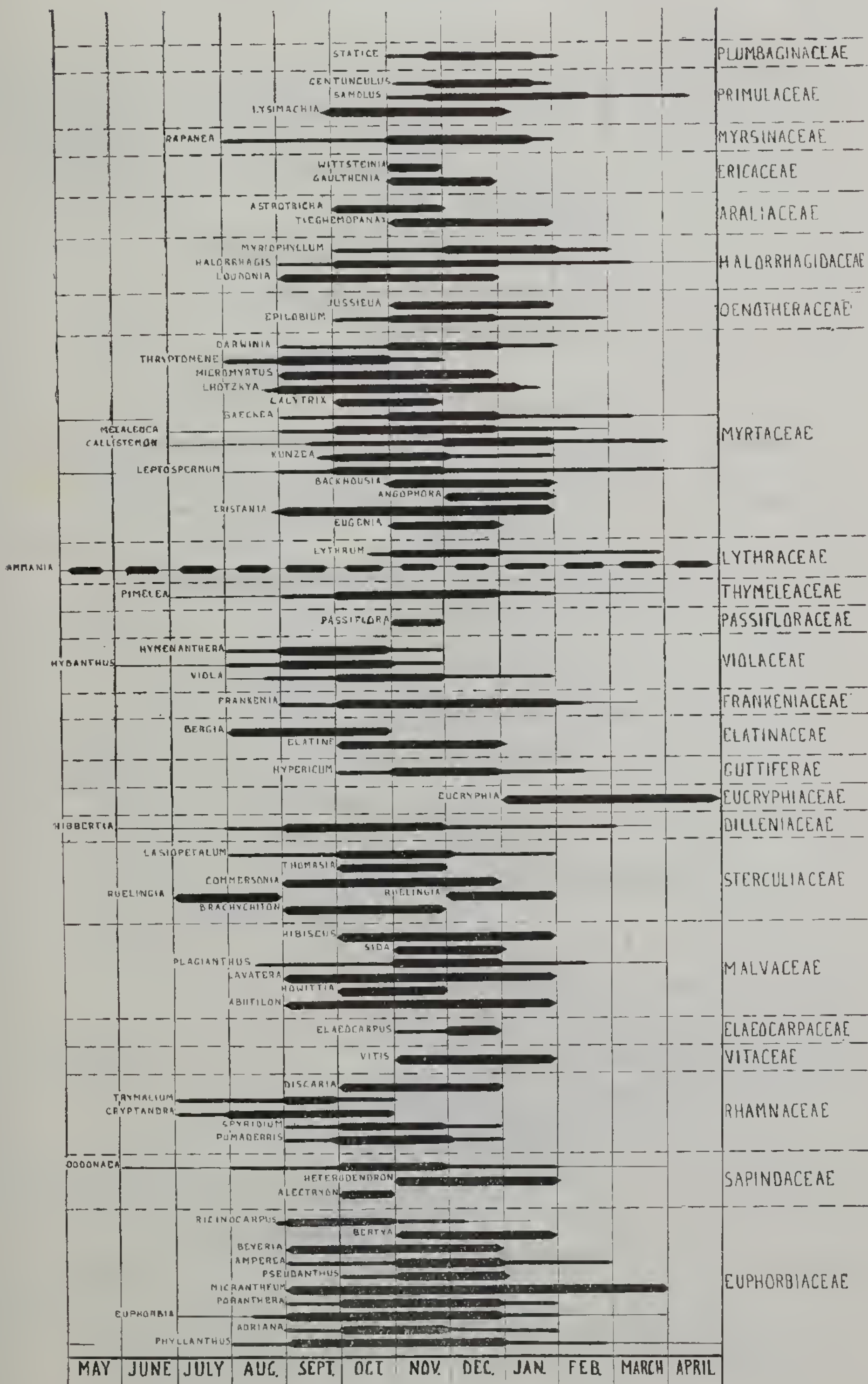
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Fig. 5.

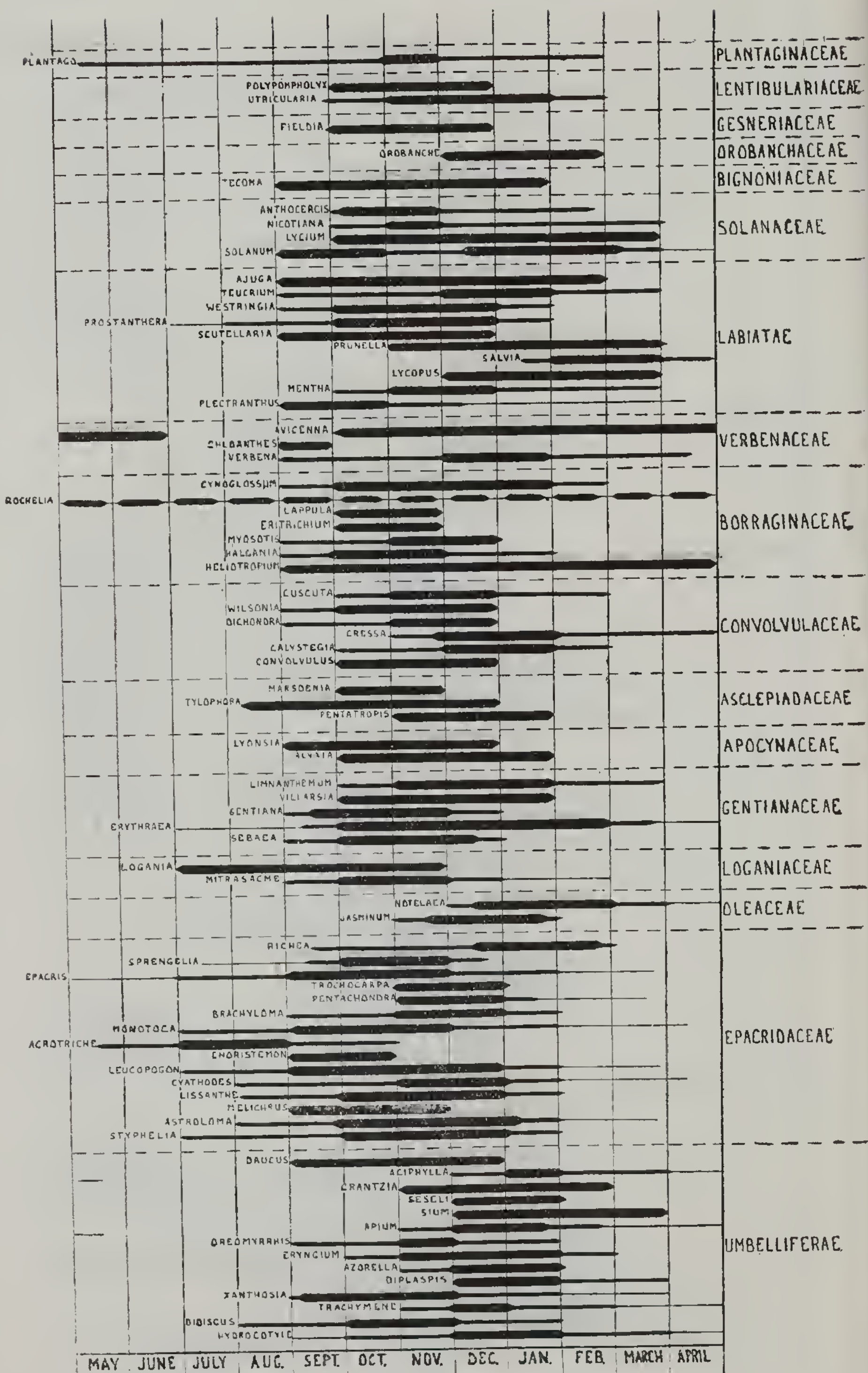
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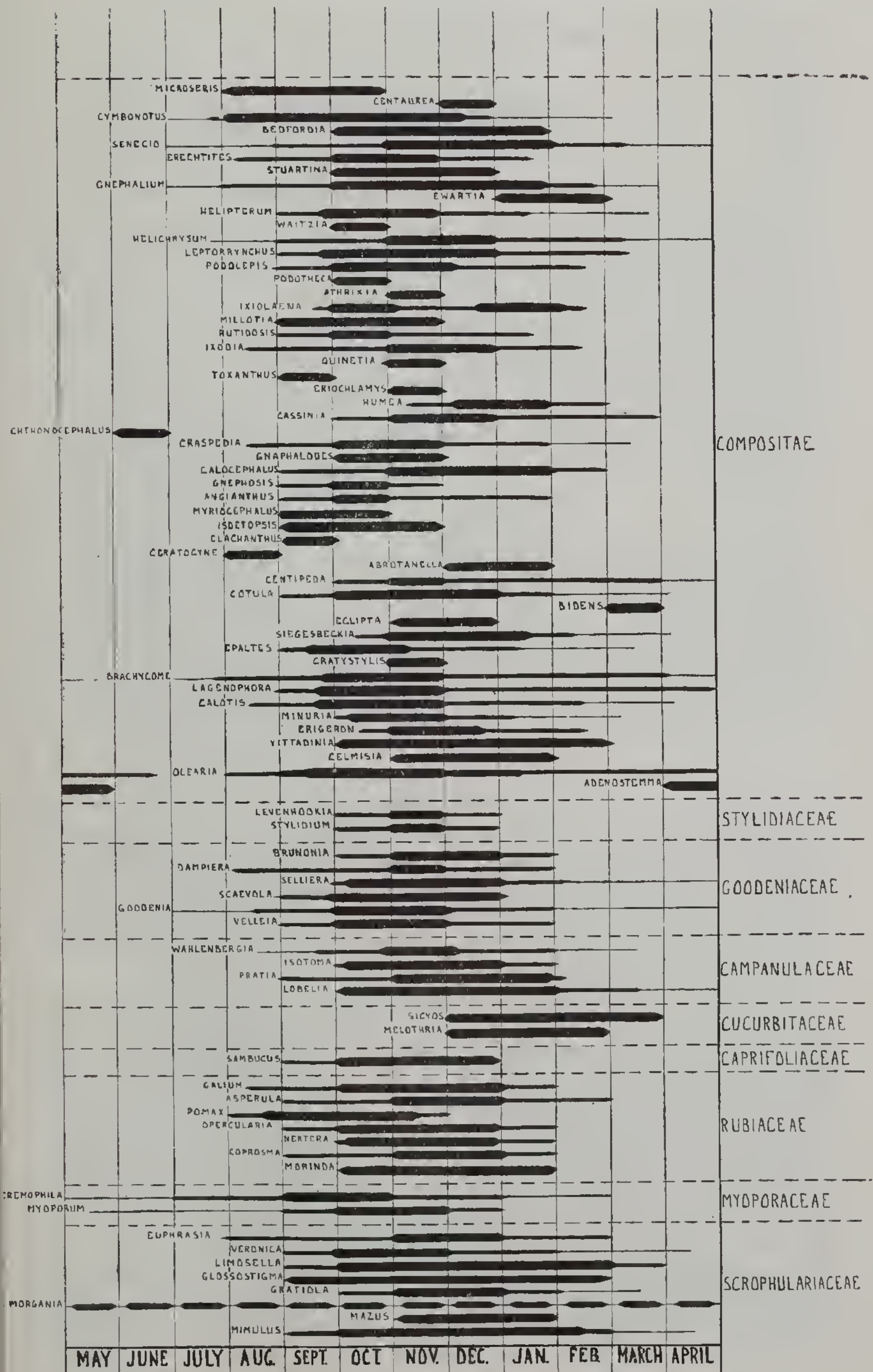
Fig. 6.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SENECIO
ERECHTITES
STUARTINA
GNEPHALIUM
EWARTIA
HELIPTERUM
WAITZIA
HELICHRYSUM
LEPTORRYNCHUS
PODOLEPIS
PODOTHECA
ATHRIXIA
IXIOLAENA
MILLOTIA
RUTIDOSIS
IXODIA
QUINETIA
TOXANTHUS
ERIOCHLAMYS
HUMEA
CASSINIA
CHTHONOCEPHALUS
CRASPEDIA
GNAPHALODES
CALOCEPHALUS
GNEPHOSIS
ANGIANTHUS
MYRIOCEPHALUS
ISOETOPSIS
CLACHANTHUS
CERATOGYNE
ABROTANELLA
CENTIPEDA
COTULA
BIDENS
ECLIPTA
SIEGESBECKIA
EPALTES
CRATYSTYLIS
BRACHYCOME
LAGENOPHORA
CALOTIS
MINURIA
ERIGERON
VITTADINIA
CELMISIA
OLEARIA
ADENOSTEMMA
COMPOSITAE
LEVENHOOKIA
STYLIDIUM
STYLIDIACEAE
BRUNONIA
DAMPIERA
SELLIERA
SCAEVOLA
GOODENIA
VELLEIA
GOODENIACEAE
WAHLENBERGIA
ISOTOMA
PRATIA
LOBELIA
CAMPANULACEAE
SICYOS
MELOTHRIA
CUCURBITACEAE
SAMBUCUS
CAPRIFOLIACEAE
GALIUM
ASPERULA
POMAX
OPERCULARIA
NERTERA
COPROSMA
MORINDA
RUBIACEAE
EREMOPHILA
MYOPORUM
MYOPORACEAE
EUPHRASIA
VERONICA
LIMOSELLA
GLOSSOSTIGMA
GRATIOLA
MORGANIA
MAZUS
MIMULUS
SCROPHULARIACEAE
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
JAN.
FEB.
MARCH
APRIL

FIG. 7.